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EDITORIAL NOTES.

STAFF.

Capt. J. M. Howlett reported his arrival on 6th April and assumed duties as Agricultural Instructor.

KRIAN PADI EXPERIMENTAL STATION.

The Krian padi Harvest results indicate that the mean yield of one hundred and twenty five lines tested in 1921-1922 season is 15% higher than the mean of native grown padi. The mean of the sixty seven selections for test in the coming season is 20% higher than the mean of this years native crop.

PLANTING MATERIAL.

A large supply of planting material of various fruit trees has now been obtained by the Department of Agriculture, and it is hoped to maintain a stock of seedlings sufficient to meet future demands.

GOVERNMENT PLANTATION, KUALA KANGSAR.

The following is a list of plants under cultivation at the Government Plantation, Kuala Kangsar, Perak.

The Superintendent in Charge will be glad to show any person interested round the Plantation.

Application for "seed" of any of these crops should be addressed to the Agriculturist, F.M.S., Kuala Lumpur.

Roselle Fibre (*Hibiscus Sabdariffa var : Altissima and var : Victor*). Bimlipatam jute (*Hibiscus Cannabinus*). Bengal jute (*Corchorus capsularis*). Kapok (*Eriodendron anfractuosum*). Bowstring Hemp (*Sansevieria sp.*). Sea Island Cotton (*Gossypium barbadense*). Kidney Cotton (*Gossypium brasiliense*). Lima bean (*Phaseolus lunatus*). Ground-nut (*Arachis hypogoea*). Sorghum (*Sorghum vulgare*). Indigo (*Indigofera arrecta*). Tuba Root (*Derris elliptica*). Jerusalem Artichoke (*Helianthus tuberosus*). Tobacco (*Nicotiana Tabacum.*) Gingelly (*Sesamum indicum*).

LOCAL PRODUCTION OF GINGELLY AS A CATCH CROP.

By J. Lambourne.

THE Gingelly, Sesamum or Teel seed plant (*Sesamum indicum*) known by Tamils as "Ellu" and by Malays as "Lenga" or "Bijan" belongs to the natural order **Pedalineae**. It is an annual herbaceous plant, 2 to 4 feet high, indigenous to Ceylon, South India and Tropical Africa and is cultivated for its seed, which yields from 40% to 50% of oil.

Gingelly is grown chiefly in India, while small quantities are grown in Java, Siam, China, Japan and the Levant. A particularly fine variety of seed comes from Palestine.

The total area of gingelly in India has been estimated at 4½ million acres, yielding 200,000 tons of seed annually. The largest areas are in Madras where over 800,000 acres are cultivated.

Market and Uses.

Large quantities of seed are imported into Northern Europe where the oil is used for a large number of purposes, including the manufacture of soap, margarine and other vegetable butters, and also as a substitute for olive oil in salad oils.

Large quantities are extracted in Marseilles, which is one of the principal European ports of import of oil seeds.

In India and Malaya the oil is used largely for culinary purposes and for anointing the body.

Soils and Cultivation.

In India, Gingelly is grown on a variety of soils, from poor dry soils to the richest delta lands. It is grown as an intermediate crop between padi seasons, when rain falls at a favourable time, and also mixed with cotton, sorghum (*Andropogon Sorghum*) and other crops. There are several varieties of seed, which vary chiefly in colour. The principal varieties are white and black seeds but the colours also range through browns and reds. The white variety is usually grown with cotton, while the black variety is grown with taller crops such as Sorghum.

The most suitable soil for the cultivation of Gingelly appears to be a well drained alluvial loam, but it can be grown successfully on fairly heavy clay soil providing it is well drained and tilled. An experimental crop of Gingelly has recently been grown on the latter

type of soil at Castleton Estate, Telok Anson and, compared with crops obtained elsewhere, the yield was good. The area planted was 2.05 acres.

The plant was grown as a catch crop between coconuts; a good crop of padi had been harvested from this land 6 weeks previous to sowing the gingelly.

The land was prepared by changkolling in the padi stubble, and harrowing after a month. The seed, which was purchased locally and consisted of several varieties, was sown broadcast at the rate of 3 lbs. per acre and harrowed in. The seed was mixed with about twice its volume of dry sand before sowing, to facilitate even distribution and to prevent its being sown too thickly. The seed was sown on 19th and 21st April, 1921 and soon germinated so that by 9th May the seedlings were large enough to be thinned. Thinning and weeding were done at the same time and the plants were left about 1-1½ ft. apart. The area was weeded again on 30th May and 26th June.

Harvesting.

The crop was harvested on 8th and 9th August, 1921. The plants were cut down to within 6 inches of the ground, tied in bundles and taken to a cleared place with a hard floor. The plants were placed in a heap for three days to allow a little heating to take place to facilitate the bursting of the seed capsules; they were then laid out to dry during the day and heaped at night, the seed which had dropped out being collected on each occasion. When the plants were quite dry, the seed was removed readily by beating out the heads.

After the threshing operation the seed was cleaned by being tossed on a rotan tray to remove dust, broken pieces of capsule, etc.; after cleaning, the seed was laid out to dry for a few days and then put up in sacks.

The harvesting, threshing, and cleaning of the crop is very simple and can be carried out without the aid of machinery, although if it were grown on a large scale, threshing and winnowing machines would facilitate cleaning, and probably would be cheaper than hand labour.

Yields.

The total crop of clean seed harvested from 2.05 acres of land was 187 gantangs, equivalent to 1,122 lbs. or 8.42 piculs. As the crop was grown among coconuts, a radius of 3 to 4 ft. must be allowed for each palm and allowance must be made also for drains and boundaries which are included in the area. Allowing 10% for this, the actual area planted with gingelly was 1.85 acres. The yield of seed therefore works out at roughly 100 gantangs per acre, equivalent to 600 lbs. or 4.55 piculs. Comparing this with yields obtained in India, which vary from 350 to 459 lbs. per acre (1) or, what is considered a good crop viz. 500 lbs., (2), the yield obtained is well above the average.

Cost of Cultivation and Harvesting.

The cost of cultivation, harvesting, and cleaning the above crop was as follows :—

	Total.	Per acre.
	$ cts.	$ cts.
Changkolling in Padi stubble ...	13.60	7.35
1 Gantang Gingelly seed ...	1.50	.81
Sowing seeds and harrowing ...	5.20	2.81
Thinning and Weeding	11.50	6.22
Harvesting	4.60	2.49
Drying and Threshing	6.30	3.41
Cleaning	4 50	2.43
Total ...	$47.20	$25.52

Value of Seed (Revenue).

The local quotations for fairly clean seed landed in Penang on 20th December, 1921, were as follows :—

Black seed	$12	per picul
Red seed	13	,,
White seed	13	,,
Mixed seed	11.75	,,

These prices were quoted subject to local handling charges and commission of 5 per cent. on sale value.

A sample of this seed was sent to Penang and $9 per picul was offered, owing to the seed being dusty and mixed. Winnowing was advised in order to obtain a higher price. The seed was however sold locally in Telok Anson for $10 per picul.

Taking the local price of $10 per picul, the profit from one acre, with a crop of 4.55 piculs is as follows :—

Value of 4.55 piculs at $10	$45.50
Less cost of production	25.52
	$19.98

Possibilities of the Crop.

The above profit is not large but, considering that the crop occupies the land for only four months, it is quite satisfactory for a small holder, especially when considered as an intermediate crop between padi seasons. If sown on new clearings among rubber or coconuts, even with a smaller profit than $20 per acre, this crop would assist considerably in paying upkeep costs. It is possible that a better yield could be obtained from new clearings and at considerably less cost, as very little cultivation would be required.

Two crops could probably be taken off a new clearing in a year and would not affect the growth of the permanent crop to any extent, providing space was allowed round each plant for its proper development.

Large quantities of Gingelly oil and seed are imported annually into Malaya and there is no reason why a portion of these requirements should not be grown locally, as the seed could be sold to owners of oil mills in Penang and Singapore and the native oil mills scattered about the country.

Yields of Oil.

By commercial methods of expression the yield of oil from gingelly seed is 32 to 35 per cent. under the system of cold pressure. After the first expression, 5 per cent. of water is added and the mass is again pressed at a temperature of 50°C. A third application of pressure is then made, yielding 10 per cent. of oil in addition to that obtained from the first two pressures. The cold pressed oil, which is the best grade, is clear, pale in colour and has only a faint taste, while that obtained from the second and third pressings is dark in colour, of a decided flavour, with a tendency to become acid. The best grades of oil are used in salads, medicines and for margarine and vegetable butter.

The residue (cake or poonac) is used as a cattle food.

The oil content of the seed varies from 40 to 50 per cent. but it will be seen from the following report by Major C. D. V. Georgi, Assistant Agricultural Chemist, that the locally produced seed was below the average.

"The seed consisted of two or three different coloured varieties, the black predominating."

"The results of analysis were as follows :—

	Per cent.	Per cent on dry material.
Moisture	6.8	
Oil (Petroleum Ether extract)...	40.2	43.1
Residue (by difference) ...	53.0	56.9
	100.0	100.0
Nitrogen	3.2	3.4
Ash	5.6	6.0

"In order to obtain a representative sample of the oil for the determination of the constants, 14 lbs. of the seed were warmed and expressed twice in a small laboratory hand press.

The total weight of oil obtained was 3 lbs. 7 ozs. equivalent to an expression of about 60 per cent. of the original oil content.

The constants for the oil were determined and the results, which are given in the table below, compare favourably with those given by Fryer and Weston "Oils, Fats, and Waxes," Volume I, page 131."

"The oil was light yellow, with only a faint odour; there was practically no deposit on standing."

	Sample	Fryer and Weston.
Density at 15.5°C	0.920	0.923
Refractive Index 40°C (ZB) ...	58.5	60.0
Iodine Value (Wijs) ...	108.8	105.0
Saponification Value ...	183.5	192.0
Acidity (as Oleic Acid per cent.)...	2.2	2.5

"*Observations.*—The oil content of the seeds is slightly below the average, 45 to 50 per cent. calculated on the dry seed being the normal amount.

The oil is easy to express and does not appear to develop any large amount of acidity."

Arrangements were also made to express 56 lbs. of the seed in a "Chekku," in order to determine the efficiency of the method and the quality of the oil extracted.

The operation took $2\frac{1}{2}$ hours for two expressions and yielded 21 lbs. of oil and 33 lbs. of poonac or cake, equivalent to 37.5 per cent. of oil and 58.9 per cent. of cake. The remaining 3.6 per cent. was lost in the process of expression.

Samples of this oil and cake were also examined by Major C. D. V. Georgi, who reported as follows:—

"*Oil.*—The oil was clear and bright, yellow in colour, with very small sediment and faint odour.

Only the figure for the acidity was determined, this was found to be 2.9 per cent. calculated as Oleic Acid, being slightly higher than that found for the oil expressed in the laboratory, but not sufficient to affect its quality.

Cake.—The cake when received was very slightly mouldy on the surface but when broken appeared quite fresh inside.
The results of analysis were as follows":—

	Per cent.	Per cent on dry material.
Moisture	11.2	...
Oil (Petroleum Ether extract) ...	11.6	13.1
Residue (by difference) ...	77.2	86.9
	100.0	100.0
Nitrogen	5.3	6.0

Conclusions.

From the above analyses it will be seen that the oil content of the seed is below the average but the oil is of good quality.

The low oil content is probably due to the fact that the crop had to be harvested before all the seed was thoroughly ripe, owing to its mixed character.

It was however necessary to harvest the crop at the date selected in order to avoid heavy loss from seeds dropping in the field. A certain amount of seed was unavoidably lost, owing to the ripe seed capsules bursting before and during harvest.

The results indicate that this crop is a suitable catch crop on young rubber or coconut estates and that there should be a good local demand for the seed.

References.—1. Agricultural Facts and Figures, Wood.

2. Indian Agriculture, Mukerji.

(Ref. D.A. 1204, 1921).

PRELIMINARY NOTES ON THE RUBBER FLOWER GOEMETRID (HEMITHEA COSTIPUNCTATA, MOORE).

By G. H. Corbett and D. Ponniah.

The habits of the Geometrid moth—*Hemithea costipunctata*—have never been previously recorded. Opportunity to study this insect was given in June, 1920, when the Agricultural Department received specimens of the caterpillars.

The manager of an Estate near Teluk Anson in his forwarding letter stated as follows:—" I found the diseased branches and blossoms in my youngest rubber (5 years and 8 months) to-day. It (the disease) apparently only attacks, or only has done so far, the lowest branches starting at the blossom and gradually working down to the branch leaving thereon a blackish discolouration. The leaves curl up, discolour slightly and eventually drop off."

Distribution.

In addition to its occurrence at Teluk Anson, the caterpillars have been found on rubber inflorescenses at the Gardens, Kuala Lumpur, and they are probably present on rubber throughout Malaya.

Extent of Injury

The caterpillars of this moth feed chiefly on the unopened blossoms of the rubber. In captivity, in the absence of unopened flowers, they feed on open flowers. It has not been found possible to rear them on young leaves, but almost full grown caterpillars have occasionally been found feeding slightly on young leaves.

The curling up, slight discolouring and eventual dropping off of the leaves are probably the result of some reaction due to the mechanical injury caused by caterpillars eating the flowers.

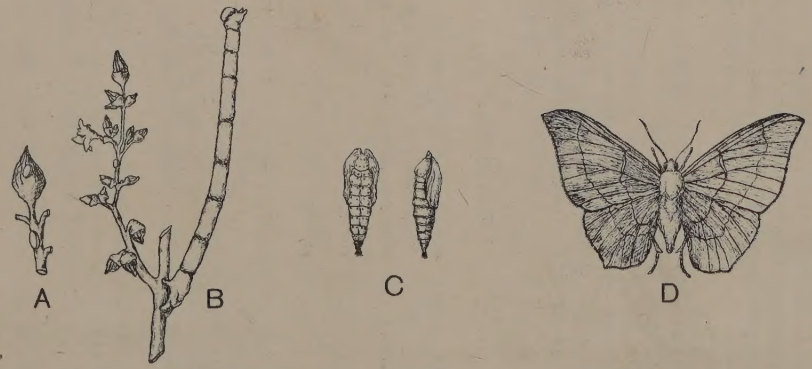
Description and Habits of the Moth.

The description of this moth is given under *Thalera costipunctata* by Moore in his Lepidoptera of Ceylon as follows:—

" Dull glaucescent—green. Cilia cinereous—white. Wings with a very indistinct transverse discal row of whitish points and a marginal row of white points: forewing with black streaks along the costal edge, and with traces of a whitish inner lunular line. Front of head, palpi, and forelegs above brownish; shaft of antennae and vertex ochreous—white. Expanse 8/10 inch."

The wing expanse of the male is slightly smaller than that of the female.

THE RUBBER FLOWER GEOMETRID



A. Eggs on Bud and Stalk of Rubber Flower
B. Larva at Rest on Inflorescence Stalk (x 2)
C. Pupae (Dorsal and Side Views) (x 2)
D. Geometrid Moth (x 2)

The moths are inactive during the day time, and copulation takes place at night.

The female commences to lay eggs four or five days after emergence from the pupa.

The maximum number of eggs laid by one female was 69. These were laid in the course of two days. On the first day 57 and on the second 12 eggs were deposited.

Males and females live for about one week after emerging from the pupae.

Description of the Egg.

The egg is flat and cylindrical in shape, shiny and light green in colour, about .35 mm in diameter and .2 mm in height. The upper surface is finely pitted.

The eggs are laid by the female moth on the unopened blossoms and flower stalks of the inflorescence of rubber, usually singly but occasionally in twos and threes, one egg being deposited above the other.

The following table gives the length of time taken for the incubation of the egg.

Table I.—*Incubation of the Egg.*

Date eggs laid.	Date eggs hatched.	Number of eggs.	Number of days.	Number of egg days.
1920.	1920.			
8-7	11-7	8	3	24
9-7	12-7	1	3	3
11-7	15-7	2	4	8
9-8	13-8	2	4	8
11-8	13-8	4	2	8
14-8	18-8	1	4	4
16-8	20-8	4	4	16
18-8	21-8	9	3	27
2-11	5-11	18	3	54
2-11	5-11	20	3	60
1921.	1291.			
1-6	3-6	40	2	80
1-6	4-6	22	3	66
1-6	4-6	2	3	6
2-6	5-6	1	3	3
6-6	9-6	1	3	3
6-6	10-6	4	4	16
6-6	10-6	2	4	8
8-6	11-6	39	3	117
8-6	12-6	29	4	116
11-6	14-6	4	3	12
	Total ...	213	...	639

On examination of Table I it will be seen that 213 eggs represent 639 egg days making the average time for the incubation of the egg three days.

The minimum length of time is two days and the maximum four days.

Description and Habits of the Caterpillar.

The larva is at first whitish green in colour with three distinct whitish lines on the dorsal surface running longitudinally throughout the length of the body.

After a few days the colour changes to pink which gives place later to pale green. This is maintained until the larva is full grown.

Prior to pupation the colour is brownish red with indications of dark green.

The body is covered with small hairs.

The head of the larva is light brown in colour with a distinct bifurcation. There are four dorsal projections on the first thoracic segment, the anterior pair are larger than the posterior.

Measurements of ten full grown caterpillars gave 23.9 mm as the average length.

The larvae have three pairs of thoracic legs with only one pair of abdominal feet placed on the ninth segment in addition to the anal pair or claspers. They progress by moving these two pairs of feet up to the thoracic legs so that the body is thrown into a large loop and are hence called "Loopers" or "Geometers."

The caterpillars generally rest during the daytime reposing at an angle from the inflorescence by clasping a pedicel of a flower. In this position they look like the stalk of a rubber flower.

The colour, resembling that of the environment, and the attitude of the larva when at rest prevent it being readily detected and account presumably for this caterpillar not being previously observed.

The length of time taken from the hatching of the egg till the larva pupates is given in the following Table II.

Table II.—*Length of Time of Larval Stage.*

Date Eggs hatched.	Date Larvae pupated.	Larval period in days.
1920.	1920.	
27-9	16-10	19
27-9	18-10	21

Date Eggs hatched.	Date Larvae pupated.	Larval period in days.
1920.	1920.	
27-9	14-10	17
27-9	15-10	18
27-9	14-10	17
5-11	30-11	25
5-11	26-11	21
18-11	5-12	17
18-11	10-12	22
19-11	8-12	19
19-11	8-12	19
1921.	1921.	
26-9	14-10	18
26-9	15-10	19
26-9	16-10	20
26-9	15-10	19
26-9	15-10	19
26-9	17-10	21
26-9	17-10	21
26-9	17-10	21
27-9	15-10	18
27-9	16-10	19
27-9	16-10	19
27-9	17-10	20
27-9	17-10	20
27-9	18-10	21

Twenty five caterpillars were separately bred from egg to pupa giving a maximum of 25 days, a minimum of 17 days, and an average of 19.6 days for the larval stage.

The larvae have been collected in the field throughout the year. The irregularity of wintering of individual rubber trees permits of a succession of generations of this insect.

Description and Habits of the Pupa.

The general colour of the pupa is pinkish, greenish in front: thorax and abdomen minutely black speckled.

A day or two before the emergence of the moth, the greenish colour changes to a dark green.

The average length of ten pupae was 10.59 mm. giving a shrinkage of 13.31 mm. in comparison to the average length of the full grown larva.

The pupa under laboratory conditions is often seen among the inflorescence suspended by its anal end to the stalk of the flowers.

The figures in the following table show the length of time the insect is in the pupal condition.

TABLE III.—*Length of time of the Pupal Stage.*

Number of Pupae	Date of Pupation.	Number of moths emerged.	Date.	Pupal Stage in days.	Number of moths emerged.	Date.	Pupal Stage in days.	Number of moths emerged.	Date.	Pupal stage in days.
	1921		1921			1921			1921	
1	21 May	1	29 May	8	...	...	...	...	...	...
2	22 ,,	1	30 ,,	8	1	31 May	9	...	...	...
2	23 ,,	2	31 ,,	8	...	...	...	...	...	...
6	24 ,,	2	31 ,,	7	4	1 June	8	...	...	...
3	25 ,,	3	2 June	8	...	...	...	...	...	...
6	26 ,,	1	2 ,,	7	5	3 June	8	...	...	...
4	27 ,,	3	4 ,,	8	1	5 ,,	9	...	...	...
11	28 ,,	6	5 ,,	8	5	6 ,,	9	...	...	...
8	29 ,,	5	6 ,,	8	3	7 ,,	9	...	...	...
1	30 ,,	1	8 ,,	9	...	...	...	...	...	...
14	31 ,,	3	7 ,,	7	7	8 June	8	4	9 June	9
4	1 June	3	8 ,,	7	1	10 ,,	9	...	...	...
7	2 ,,	2	10 ,,	8	4	11 ,,	9	1	12 June	10
5	3 ,,	2	11 ,,	8	3	12 ,,	9	...	...	...
6	4 ,,	6	13 ,,	9	...	...	...	...	...	...
4	6 ,,	2	14 ,,	8	2	15 June	9	...	...	...
1	14 Oct.	1	24 Oct.	10	...	...	...	...	...	...
1	14 ,,	1	23 ,,	9	...	...	...	...	...	...
1	15 ,,	1	24 ,,	9	...	...	...	...	...	...
1	16 ,,	1	25 ,,	9	...	...	...	...	...	...
1	17 ,,	1	26 ,,	9	...	...	...	...	...	...
1	22 ,,	1	30 ,,	8	...	...	...	...	...	...
1	22 ,,	1	1 Nov.	10	...	...	...	...	...	...
1	24 ,,	1	1 ,,	8	...	...	...	...	...	...
1	24 ,,	1	1 ,,	8	...	...	...	...	...	...
1	27 ,,	1	5 ,,	9	...	...	...	...	...	...
1	27 ,,	1	5 ,,	9	...	...	...	...	...	...
95		...						...		

It will be noticed from the above Table III that out of a total of ninety five pupae, nine adults emerged on the seventh day, forty six on the eighth, thirty-seven on the ninth and three on the tenth.

Synopsis of Life Cycle.

	Minimum	Maximum	Average
Egg Stage ...	2	4	3
Larval Stage ...	17	25	19.6
Pupal Stage ...	7	10	8.3
	26	39	30.9

Parasites.

Caterpillars have been collected parasitised by a small hymenopterous insect and a tachinid fly.

Conclusion.

Whilst Hemithea is of interest from an entomological point of view in so far that nothing was previously known concerning its habits and its presence on rubber had not been detected, it is at present of no serious importance, but if seeds are required commercially for the extraction of oil further observations as to its habits and control will be necessary.

WORK OF THE INSPECTION STAFF.

JANUARY—MARCH, 1922.

By F. W. South.

STAFF.

CAPTAIN S. D. TIMSON proceeded to Penang and took up his duties as Assistant Agricultural Inspector, Penang and Province Wellesley.

The Staff of Special Field Officers in Negri Sembilan has now been reduced to three. This number is considered sufficient to supplement the work of the permanent Inspection Staff in the State now that Mouldy Rot disease is more regularly treated and is under better control.

Estate Visits.

During the quarter one hundred and nineteen visits were paid by the Chief Agricultural Inspector and the Assistant Agricultural Inspector to estates in various parts of the Peninsula.

Diseases of Rubber.

Pink Disease: This disease was newly reported from three estates in Perak North, three in Perak South, three in Selangor and four in Johore.

This disease is fairly prevalent on the eastern border of Province Wellesley adjoining Kedah. It is being well treated in the Province, but unfortunately nothing much is being done on the Kedah side of the boundary. Attention has been called to this point in the past. There was one case in the previous quarter at Pokok Manggis on the seaward side of Penang. This was treated and no further cases have been found. The appearance of a solitary case in such a situation is peculiar.

In Perak North attention has been given to one European owned estate on which the disease was being neglected owing to lack of money for disease control. Routine inspection of small holdings for this disease has been maintained.

In Perak South there have been records of small outbreaks in Kinta all of which have received attention. Such reports are gradually becoming more frequent, though the disease is still of little importance in this district. The disease was as usual prevalent in Batang Padang district, but is being kept under control by the efforts of the inspecting officers. There has been a distinct improvement around Tanjong Malim.

In Selangor, probably owing to the wet weather prevailing during the quarter, the disease has spread in Ulu Selangor district in a westerly direction from Batang Berjuntai and south westerly from Kuang and Sungei Buloh towards Kuala Selangor district in an area where there are several young estates with trees, now at the most susceptible age, from 3 to 6 years old. Useful control work has been maintained, however, by all the Special Field Officers. It is worthy of note that the Special Field Officer has been able to establish a co-operative system for treating the disease among small holders at Ulu Yam and Batang Kali. There has been considerable improvement around Bangi in Ulu Langat district and attention can now be turned to other parts of the the district where cases of the disease are found. The disease was treated by officers of the department on 20 holdings in Selangor.

There is nothing but routine work to be recorded concerning this disease in Pahang, Negri Sembilan and Johore. No cases were found in Malacca during the quarter.

Mouldy Rot.—There was a marked reduction in the prevalence of this disease in all districts of Negri Sembilan, partly owing to a spell of dry weather in February, but also to a considerable extent to the extra care and attention now given to the treatment of infected trees on small holdings as a result of the work of the department's officers. Work was done by the department on one holding in Seremban district and on one neglected Chinese holding near Pengkalen Kempas during this quarter. Such action is reported to have a considerable influence on the small holders. There has been no difficulty so far in recovering the cost of this work in Negri Sembilan.

It is worthy of record that isolated cases have been appearing on various portions of an estate in the Coast district though nothing in the nature of an epidemic has been experienced. This appears to be quite unusual, as thorough and efficient treatment has been carried on since the presence of the disease was first confirmed there during the quarter. A further visit to investigate the cause of these sporadic attacks will be made.

It is satisfactory to be able to record that the efforts of the Assistant Agricultural Inspector, Malacca, resulted in the disappearance of Mouldy Rot disease from the infected estate near Alor Gajah, the estate was quite free from it during the quarter, but will be kept under observation in case fresh cases appear in wetter weather. The reappearance of the disease in this way in places that have temporarily become free from it is frequently recorded.

In Johore the disease once more made its appearance on two holdings near Johore Bahru. Unfortunately it has spread to the Batu Pahat district and is common near the Muar boundary. It has not been found on the the South side of the Batu Pahat river yet. Owners of estates and small holdings have been warned to report it at once if found. With the prolonged drought and the active attention of inspecting officers in Muar and Segamat districts, this disease is less frequently met with, but in Panchor district it is still common.

Black Stripe.—This disease was newly reported from 2 estates in Selangor during the quarter. A few other outbreaks are known to have occurred in the State and to have received proper attention. The sale of "Agrisol" at cost price to small holders around Kajang has been continued, but the demand is not so great as it was three months ago, owing to an improvement in the condition of the areas infected.

The condition of the estate at Jelebu referred to in previous reports is now improved. No fresh infections have been recorded.

It is stated that no cases of this disease were reported from Kuantan district this year, although there is usually a considerable amount of it during the monsoon.

Patch Canker.—This disease is present on one estate in Perak North on very old trees. For some time past it has received regular routine treatment. One case was reported from an estate in Malacca.

Root Diseases.—On one estate in Province Wellesley an area of coconuts was cut out and replanted with rubber, the coconut trunks being buried in situ. The ill results of this practice, to which attention has been called in the *Agricultural Bulletin*, are now evident in the number of rubber trees killed by root diseases or cut out on account of infection. In such a case coconut refuse should not be buried, but should be dried, split and burnt.

There was a virulent outbreak of Fomes and wet rot (*Fomes pseudoferreus*) on one estate and of wet rot on another estate in Negri Sembilan. The Assistant Agricultural Inspector states that the occurrence of wet rot is becoming more general in Negri Sembilan, cases being found on most holdings growing old rubber. The danger of this disease is never realised by the grower, and proper treatment is seldom carried out, except when the consequences of neglect are explained.

Crickets.—These insects were again found to be doing some damage to the bark of rubber trees on an estate in Malacca, but after a shower of rain they disappeared.

No other diseases of rubber call for special attention. Routine work to enforce the destruction of decaying rubber stumps, trunks, or large branches has been continued.

Lalang and Blukar.

The coconut holdings at Beserah near Kuantan are reported to be now all cleaned. In Malacca steps are being taken to have holdings cleared when the owners can be found and the work can be done without undue financial hardship. The general policy in regard to untidy holdings remains unchanged, since owners of rubber land still cannot afford to clear their holdings in many cases.

Coconut Pests and Diseases.

Beetles.—The Black beetle (*Oryctes rhinoceros*) is doing much damage to coconut palms in Penang and Province Wellesley where suitable breeding grounds in the form of decaying coconut and other vegetable refuse abound. At present the main work of the inspecting officers is concentrated on the destruction of these breeding places and of the grubs found in them. Every effort is being made to educate the Asiatic small holders to realise the need for destroying all such refuse ; at the same time the co-operation of Government Officers and of European land owners and Managers has been obtained in disposing of all such rubbish on land in their charge. In the past the fact that Crown lands and European owned lands have been neglected from the point of view of plant sanitation, especially as regards coconuts, has increased the difficulty of inducing small holders to do the work necessary without compulsion.

The work is being done systematically lot by lot and mukim by mukim and is necessarily slow, but satisfactory progress is being made.

In Perak this work is continued as part of the usual routine. Bagan Datoh district is receiving special attention as beetles are very common there.

In Selangor the condition of the coconut trees in Klang and Kuala Selangor districts has been bad and a cooly has been employed in each district to treat trees on State land and to do work required if owners fail to comply with instructions. The inspecting officers in these districts are concentrating their attention on this matter at present. It is too early to give results yet, but it is expected that an improvement will first be shewn in Kuala Selangor, where a number of breeding grounds has been discovered and destroyed on both sides of the river. In Klang and Port Swettenham, however, the number of actual breeding grounds discovered has been small, and work has consisted mainly of treating attacked trees and destroying potential breeding grounds.

Routine work has been continued steadily in Negri Sembilan, attention being given specially to bullock stables near towns, since these are the principal breeding grounds of black beetles in most parts of the State. The destruction of various breeding grounds at Port Dickson has resulted in a distinct improvement in the trees there.

In Malacca the Assistant Agricultural Inspector reports that there are now very few dead coconut stumps and timbers or decaying palms of Rembia, Kabong and Pinang to be found in the kampongs. The campaign against the beetles has here been successful and produced good results. Grubs of Black Beetle are now difficult to find.

The Hon. the Resident Councillor, Malacca, has given the department useful assistance in this work by requiring each Penghulu to inspect the trees in his mukim periodically and give detailed reports of the existence of dead stumps and timbers to the District Officer who in turn sends them to the Assistant Agricultural Inspector.

Skipper caterpillars.—An outbreak occurred and was reported on one estate in Perak South. The Government Entomologist and the Assistant Agricultural Inspector visited the estate and the Government Entomologist recommended the use of a solution for spraying the trees. The results of its use are not yet known.

Pests of Padi.

Stem Borer.—The Assistant Agricultural Inspector, Perak North, states that this pest can be found wherever padi is grown in Perak. There is little doubt but that it materially reduces the crop throughout, but it is difficult to estimate to what extent. There has been no abnormal increase of the pest resulting in severe damage to the crop in some localities, as was the case last year. In contrast it may be recorded that the Assistant Agricultural Inspector, Penang and Province Wellesley, has not found, or received reports of, serious damage by these pests in Penang or Province Wellesley, though there are probably isolated cases in the south of the Province.

Nephotettix.—"Bena" this pest increased to sufficient numbers in two localities in Perak North to destroy about ¼ acre of padi in each case. Otherwise it did no special damage.

Podops coarctata.—"Bena Kura" or "Kutu Bruang" no reports of damage by this pest have been received. The pest is, however, present in quantity living in padi stubble in bendangs in certain localities in the sub-district of Bruas. It is practically certain that, should there be an insufficiency of water for any length of time during the next padi growing season, considerable damage will be done by this pest in the localities referred to. Improvement in irrigation would appear to be the only practical way of reducing this pest and of keeping it in check. This insect is also recorded on padi stubble in Perak South.

Grasshoppers.—These were plentiful in many places in Penang and Province Wellesley, but did very little damage. They are recorded as doing a considerable amount of damage in one field in Kuantan district, but did not spread. This is probably the same attack as was referred to in my last report.

Rats.—The Assistant Agricultural Inspector, Selangor, reports that a certain amount of interest is being displayed in Kuala Langat and in Kuala Selangor districts in connexion with measures against rats. The value of barium carbonate as a poison, and general information on its use in conjunction with traps, have been communicated to the District Officers, and to a number of Malays.

Water Hyacinth.

At the end of January the Executive Engineer, Krian, sent in a list of bendangs on which Water Hyacinth was present. In every case the owners of the infected bendangs destroyed the plants when asked to do so.

The special gang in Perak North carried out routine work in clearing the pest from water courses in Krian. At the end of the quarter it was engaged on clearing the pest from swamps on either side of the railway line near Alor Pongsu. The wages of the coolies in this gang were reduced from 1st March.

The plant has been removed from the land occupied by Chinese squatters near Telok Anson.

In Selangor instructions were sent to all Inspecting Officers to take steps against this pest. Two places in Kuala Lumpur district were cleaned up, while in the remaining districts, localities where Water Hyacinth is growing were marked down for future action.

Other Pests and Diseases.

Die-back of Cloves.—A form of die-back is prevalent in Penang among the groves of cloves dotting the hill sides. The causative agent is at present unknown. Small holders report that the die-back only occurs after the trees have attained a certain age at present not determined. The matter is being investigated and suitable specimens when obtained will be sent to the Mycologist.

Sugar Cane borer.—This is becoming verv common in Negri Sembilan. Its treatment is difficult, especially as it does not appear materially to damage the cane for the purposes for which it is used at present.

Banana Leaf Curler.—This skipper caterpillar was frequently met with in Negri Sembilan, especially on wild bananas. It was also fairly common in Selangor.

Pests on Roselle.—Several cases of mite attack on the leaves of this plant were noticed in Malacca and specimens were sent to the Entomologist. This mite induces curling of the leaves and shoot.

From another estate diseased specimens of Roselle were found to be suffering from eel-worm attacks. These animals killed some plants in the plot on the Experimental Plantation at Serdang.

SOME NOTES ON RUBBER ESTATES OF THE FUTURE.

By Victor Ris.

[The following article is reprinted from the Archief Voor de Rubbercultuur, VI, No. 6, 1922, in the hope of stimulating discussion. It should be borne in mind that the figures are forecasts, based on expected yields from bud-grafted rubber. Time alone will show whether such yields can be obtained and maintained.

Mr. Ris omits any reference to the probable effect on the market of any large increase of production, although this might be disastrous. Recent experience does not suggest that agreement limiting the area of selected rubber to be planted would be readily obtained, while the risk of loss from disease or accident would be increased.

For the present, Malaya has nothing to fear—should the next five years show the possession of bud-grafted rubber to be essential for survival there would be ample time to start planting operations, and in the interim production costs on the existing plantations could be largely reduced by going for maximum production regardless of injury.

The location of new plantations would present difficulties, as it is doubtful whether much of the present area under rubber could safely be replanted without extensive and expensive cultivation, while badly washed slopes would probably be useless.

For the present for the majority of estates in the F.M.S. the soundest policy would appear to be that of "wait and see".—W.N.C.B.]

1. The influence of selection of planting material on the yield of rubber estates.

UNTIL very recently, in fact, almost until the extensive opening up of Rubber lands was discontinued in consequence of the rapidly decreasing price, all Rubber Estates in the East were planted up with more or less unselected seed. No selection on a clear scientific basis had anywhere been adopted, that is to say, nowhere to any appreciable extent.

The result of planting up such large areas with unselected material is now clearly to be seen everywhere and the following figures illustrate what may be considered to hold good for the majority of Estates in the East when their full planted up acreage is considered.

It may be said that 75% of the planted trees yield 40% of the Crop and 25% of the planted trees yield the balance of 60%.

These trees are hereafter referred to as Class A and Class B trees respectively.

Of the total number of planted trees on an Estate 10% may be said to yield 25% of the Crop whilst 1% of the total planted trees yield 5% of the Crop.

Such trees are hereafter referred to as Class C and Class D trees respectively.

Under "Class A" are included many trees which yield no latex or practically none. Under "Class D" are included trees whose records show they yield year after year between 55 and 60 lbs.

On the basis of these figures we can deduce that an average Estate yielding at present 400 lbs per acre per annum could be expected to yield if planted:

with trees described above as		*class* "*B*"	960 lbs.	per annum
do	do	*class* "*C*"	1000	do
do	do	*class* "*D*"	2000	do

The figures further clearly prove what has been already stated above, i. e. that not only has unselected planting material been used for planting up Estates, but that, taken on the average, *poor* planting material has been used and that it is most important that for future plantings the planting material should be most carefully selected on scientific lines.

In the Dutch East Indies this urgent need has been recognised for a good many years and the highly trained staffs of Botanists attached to the Experimental Stations, and I may here especially mention the Research Stations of the AVROS, have been extensively engaged on work connected with the Hevea selection problem.

The results of their Research work so far obtained show:

(*a*) That the greatest success is attained in grafting or budding parts of selected high yielders on to the young root system of ordinary trees, thereby solving the problem of multiplication of high yielders in a short space of time.

The stems developed from such buddings show all the valuable characteristics of the mother tree. Structure of bark, number of latex carrying vessels, etc., in the offspring stem are equal to those in the mother tree. There is therefore every reason to believe that trees so grown will equal, or at any rate approximate, the yield of the mother trees.

In this connection it is interesting to note, as a further proof that the characteristics of the mother tree will be found in the tree grown from buddings, that the offsprings of yellow latex yielding mother trees yield also yellow latex whilst offsprings of white latex yielders yield white latex. As a matter of fact, one can go so far as to say

that if an "eye" of a yellow latex yielder is grafted on to a white latex yielding stem, a tapping cut made at a later date across the grafting point yields in the upper part yellow latex and in the lower portion white latex. This is merely of course mentioned as a side light on the possibilities of grafting.

Grafting has passed out of the experimental stage and it can be adopted with the best results for any new Rubber Clearings. It is a fact that some hundred thousand graftings have already been carried out with complete success and grafting material from highly selected trees is beginning to form an "article of commerce." First class material is now being very eagerly sought for in many quarters. The AVROS Research Station alone supplied to its members in 1921 about 6,000 meters of branch of selected trees. One meter carries about 10 sleeping eyes suitable for budding.

(*b*) The slower process of multiplication of high yielders, *i.e.* the process of generative selection, is also being very carefully gone into and satisfactory results have already been obtained.

After extensive and often pretty costly experiments it has been possible to obtain self pollination on some selected high yielders. In this way it becomes possible to arrive eventually at the isolation of biologically speaking "pure lines," the selection which is considered to be the ideal one.

This selection naturally will take time before full results are obtained, because "pure lines" can only be determined as such after several generations have proved to show constant characteristics, *i.e.* proved that the characteristics are hereditary.

Moreover even if full results are eventually obtained such "pure line" selection and production of "pure line" seed will very probably never yield sufficient seed for planting up large areas.

The limited number of high class pure line seeds will in all probability mostly be used for growing trees to be used for budding material. Budding as mentioned under (*a*) will therefore remain most probably the principal method of multiplication of high yielders in a short space of time.

2. The influence of the selection of soil on the yield of rubber estates.

Until quite recently, it was taken for granted in the Rubber world that *Hevea Brasiliensis* would grow a paying crop almost anywhere in the Tropics. That Hevea can grow anywhere, or at least keep alive anywhere, is proved to be about correct, but the idea that Hevea would yield a paying crop anywhere has been proved to be a fatal mistake.

Such mistakes have been made in every Rubber planting country in the East; any soil from bare sand flats, peat land to abrupt and rocky hill sides, all classes of soil have been planted up.

The range available for comparison so far as yield per planted acre goes is therefore a very wide one and instances of the extent to which the quality of the soil influences the yield per acre are not far to find. They are at hand in every Rubber producing country.

I intend to deal hereafter especially with conditions prevailing in the East Coast of Sumatra, but all that is to be said can be taken as holding good, mutatis mutandis, in other Eastern Rubber producing countries.

The bulk of the Estates are as already stated planted up with unselected seeds originating all from the same sources and the Estates, therefore, from this point of view, can be taken as being built up on parallel lines. The seed factor can thus be eliminated when the yields of different soils are compared, so also can climatic conditions which are excellent from seacoast to the foot of the hills, from South to North.

But the yield per Acre varies from 250 lbs. per acre to 600 lbs. per acre in specially good fields although considerably higher figures are recorded. It is now, I think quite clear that such variations, a full 140% in yield, form the strongest indication, in fact the clearest possible proof, that the quality of the soil is a prominent factor determining (all other conditions being equal) the yield of the Rubber tree.

Eliminating about 80,000 acres planted on East Coast yielding under 300 lbs. per acre the balance can be taken as yielding an average 400 lbs. per acre per year. Now keeping in view that there are large fields capable of yielding 600 lbs (and over) one is forced to conclude that proper selection of soil influences the yield by an increase of 50%. Taking extreme figures in this connection, 250 lbs and 600 lbs, the influence would be by 140%.

3. The Combined Influence of Seed Selection and Soil Selection on the Yield of Rubber Estates.

Under heading (1) I have said that:

an acre planted with	class "b" trees	would yield	960 lbs
do.	class "c"	do.	1000 ,,
do.	class "d"	do.	2000 ,,
on average soil yielding from unselected seeds			300 ,,

Under heading (2) I explained that by soil selection the yield can be improved by 50% as compared with the yield of existing average Estates. Therefore:

One acre class "b" trees	planted	on selected land	can be expected to yield 1440 lbs.
One acre class "c"	do	do	1500 ,,
One acre class "d"	do	do	3000 ,,

In the light of yields as now obtained on average Rubber Estates these figures seem extraordinary, but in my opinion one must look at same as possible figures, certainly so, as far as the intrinsic yielding capacity of selected fields is concerned. The first two mentioned should be obtainable under reasonably careful selection of both factors, seed and soil, whilst the third should be obtainable under exceptionally favourable circumstances and is therefore more of theoretical interest only.

Still, personally, I should not venture to estimate for such yields in respect of any larger Rubber areas to be opened up in future notwithstanding that I am fully convinced that Rubber Estates can be laid out and show an intrinsic yielding capacity as stated for class "b" and class "c" trees.

But intrinsic yielding capacity and actually obtainable yields are two different matters. A number of factors such as for instance the necessity to rest a number of trees from time to time, the influence of the tapping system and tapping force on the yield, are factors which in practice must tend to keep the actual yield well below the maximum the trees are theoretically able to give.

As regards "resting" nothing at this juncture can be said for certain, but from past experience one can deduce the trees benefit greatly by being rested from time to time for shorter or longer periods.

As regards "tapping system" the final word has certainly not yet been said, but in all probability any new system for extracting latex from the trees will always be a system by which not the last drop of latex will or can be extracted and by which the cambium will not be overirritated. Past experience with drastic systems, the cause of Brown Bast and all the misery connected with such, have served as a good lesson.

So far as the influence of the factor "tapping force" goes everyone knows that in the way the tapping force must be used at present, little chance is given the individual tree to yield its best. Improvements as compared with present day methods will certainly be effected in the future but the actual results obtained by any large force, even the best, will always remain below estimated possible results. No large force will ever consist of ideal tappers only, one will always have to be content with average skill.

How these factors and perhaps many others, will affect the actual yield if such is compared with the intrinsic yielding capacity, is difficult to ascertain at this juncture. A number of those who apparently forget to take the adverse factors into their calculations estimate future yields to reach 1500, 2000 and more lbs. per acre and others who are more conversant with the practical, daily working of Estates do not hesitate to estimate for at least 1,200 lbs. In my opinion the latter will be nearer reality than the former.

For the purpose of the following calculation I take a yield of 1,000 lbs. per acre per annum and in doing so, I am sure, I am on the

safe side. (Selection influenced the yield of sugar cane and cinchona by almost tripling the output as compared with former unselected cultivations).

4. Calculation of cost per lb. of rubber for Estates in full bearing of 2,000 acres yielding 2,000,000 lbs. per annum.

It can now be safely stated that Estates producing 400 lbs. per Acre under no restriction scheme can place their rubber on the London market at an "all in cost" of 40 cents. or say 8d per lb. Of that sum 26 cents. represents "Estates Cost" and 14 cents. the cost from f.o.b. to "Sold London."

The "all in cost" per lb. for producers of 1,000 lbs. per acre would fall to about 25 cents. or approximately 5d. per lb. "all in."

The annual net returns per acre from Estates yielding 400 lbs. and 1,000 lbs. respectively therefore compare as follows:

Selling price per lb.	Net return per acre yielding 400 lbs.	Net return per acre yielding 1,000 lbs.
5 d.	loss £. 5.—.—	£. —.—.—
6 d.	loss 3. 6. 8	profit 4. 3. 4
7 d.	loss 1.13. 4	do. 8. 6. 8
8 d.	—.—.—	do. 12.10. 0
9 d.	profit 1.13. 4	do. 16.13. 4
10 d.	do. 3. 6. 8	do. 20.16. 8
11 d.	do. 5. 0. 0	do. 25.—.—
12 d.	do. 6.13. 4	do. 29. 3. 4

The uncertain factors of Governments income taxes is of course left out of account.

The actual capital cost per acre of the existing 400 lbs. yielders can probably be taken as falling between £50.—and £60.—whilst the cost of the 1000 lbs. yielders to be opened up in future may be taken as lying between £70.- and £80.—

Considering the possibilities and merits of stringent selection of planting material and soil to be planted up, one is perhaps doing well to bear in mind the excellent results obtained in the Dutch East Indies during the latter half of the last century in the cultivation of the sugar cane, cinchona and tobacco and to remember that no other Eastern Tropical colonies can compete successfully with the Dutch East Indies on the world's market in these lines.

Medan, January 1922.

Abstract of Meteorological Readings in the various Districts of Malaya for the month of April, 1922.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum	Minimum	Range	Mean Wet Bulb	Vapour Tension	Dew Point	Humidity			
Kelantan, Kota Bahru	...	146.33	81.1	88.66	74.30	14.36	76.5	.823	73.4	77%	...	33.77	6.64
Pahang, Kuala Lipis	...	...	80.8	89.7	72.3	17.4	76.7	...	...	...	...	10.80	2.36
Johore, Johore Bahru	...	...	...	89.88	73.83	...	...	...	...	...	...	8.08	1.37
Singapore, Kandang Kerbau	1013.5	...	82.6	82.1	78.4	...	77.5	.921	...	...	Calm.	6.63	1.96
Malacca, Durian Daun	1017.6	127.	82.	89.	75.	14.	79.	.936	...	84.	N. W.	9.01	2.32
Negri Sembilan, Seremban	...	154.2	81.5	89.8	74.1	15.7	73.7	.782	71.9	72.9	N. W.	7.08	1.49
,, Kuala Pilah	...	153.6	82.7	90.3	72.6	17.7	78.9	.911	76.2	78.6	...	4.46	1.22
,, Port Dickson	...	158.5	83.4	89.7	75.1	14.6	78.7	.882	75.7	77.6	...	6.11	1.20
Selangor, Kuala Lumpur	...	152.6	81.3	90.2	74.6	15.6	77.4	.849	74.3	77.	S. E.	5.39	1.13
,, Klang	...	...	...	86.0	75.2	10.8	79.6	...	..	...	...	8.18	2.50
,, Kuala Selangor	...	...	...	90.2	69.9	20.3	...	...	...	...	...	6.13	2.32
,, Rawang	...	...	...	...	...	...	...	...	...	...	...	1.88	.80
Perak, Telok Anson	...	...	82.25	93.	70.	23.	78.03	.904	...	83.	...	11.61	1.85
,, Ipoh	...	...	82.90	96.	71.	25.	77.10	.867	75.34	77.	...	8.46	1.10
,, Taiping	...	...	83.1	95.	72.	22.	77.95	.889	...	79.	...	5.47	3.34
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	26.88	3.97
,, Parit Buntar	...	...	83.56	93.	71.	23.	78.74	.917	...	81.	...	10.66	2.59
Penang, George Town	1008.6	185.	81.4	93.	67.	26.	79.5	...	72.6	87.4	N. W.	.08	.01
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	13.75	3.72
Perlis, Kangar	...	...	..	90.63	74.10	16.53	...	...	...	...	...	5.39	1.29